

Pneumonia

Pneumonia

- **Pneumonia is as an acute respiratory illness associated with recently developed radiological pulmonary shadowing.**
- **May be segmental, lobar or multi-lobar.**
- **In which pneumonia develops is highly suggestive of the likely organism(s) involved.**
- **Pneumonias are usually classified as:-**
 - **Community -acquired.**
 - **Hospital-acquired.**
 - **Those occurring in immunocompromised hosts.**

Pneumonia

- **Lobar pneumonia;**- is a radiological and pathological term referring to;-
 - Homogeneous consolidation of one or more lung lobes.
 - Often with associated pleural inflammation.
- **Bronchopneumonia** refers to;-
 - More patchy alveolar consolidation associated with bronchial and bronchiolar inflammation.
 - Often affecting both lower lobes.

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❖ Community-acquired pneumonia :-

- CAP may affect all age groups but is particularly common at the extremes of age.
- Most cases are spread by droplet infection.
- CAP may occur in previously healthy individuals.
- Several factors may impair the effectiveness of local defenses and predispose to CAP.
- *Streptococcus pneumoniae* remains the most common infecting agent.
- Other organisms may be involved depends on the age of the patient and the clinical context.
- Viral infections are recognized as important causes of CAP in children and their contribution to adult CAP is increasingly recognized.

Pneumonia

❖ **Community-acquired pneumonia :-**

➤ **Factors that predispose to pneumonia**

Cigarette smoking	Recent influenza infection
Upper respiratory tract infections	Pre-existing lung disease
Alcohol	HIV
Glucocorticoid therapy	Indoor air pollution
Old age	

Pneumonia

❖ Community-acquired pneumonia :-

➤ Organisms causing community-acquired pneumonia

Bacteria

Streptococcus pneumoniae

Chlamydia pneumoniae

Chlamydia psittaci

Mycoplasma pneumoniae

Hemophilus influenzae

Coxiella burnetii (Q fever)

Legionella pneumophila

Staphylococcus aureus

Klebsiella pneumoniae

Viruses

Influenza, parainfluenza

Varicella

Herpes simplex

Measles

Adenovirus

Cytomegalovirus

Coronaviruses

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❖ Community-acquired pneumonia :-

❑ Clinical features :-

- Pneumonia, usually presents as an acute illness.
- Systemic features, such as;-
 - ✓ Fever.
 - ✓ Rigors.
 - ✓ Shivering.
 - ✓ Malaise.
 - ✓ Delirium may be present.

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❖ **Community-acquired pneumonia :-**

❑ **Clinical features :-**

- The appetite is invariably lost and headache frequently reported.
- Pulmonary symptoms include cough;-
 - ✓ Firstly is characteristically short, painful and dry.
 - ✓ Later is accompanied by the expectoration of mucopurulent sputum.
- Rust-colored sputum may be produced by patients with Strep. Pneumoniae infection.
- Occasional patient may report hemoptysis.
- Pleuritic chest pain may be a presenting feature and on occasion may be referred to the shoulder or anterior abdominal wall.

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❖ Community-acquired pneumonia :-

❑ Clinical features :-

- Upper abdominal tenderness is sometimes apparent in patients with lower lobe pneumonia or those with associated hepatitis.
- Less typical presentations may be seen in the very young and the elderly.
- Different organisms often give rise to a similar clinical and radiological picture.
- Organisms may be possible to infer the likely agent from the clinical context.
- *Mycoplasma pneumoniae* is more common in young people and rare in the elderly.
- *Hemophilus influenzae* is more common in the elderly, particularly if underlying lung disease is present.

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❖ Community-acquired pneumonia :-

❑ Clinical features :-

- Organisms may be possible to infer the likely agent from the clinical context.
- Legionella pneumophila occurs in local outbreaks centered on contaminated cooling towers in hotels, hospitals and other industries.
- Staph. aureus is more common following an episode of influenza.
- Klebsiella pneumonia has a specific association with alcohol abuse and often presents with a particularly severe bacteraemia illness.

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❖ Community-acquired pneumonia :-

❑ Clinical features :-

- Clinical examination should first focus on:-
 - ✓ The respiratory rate.
 - ✓ The pulse rate.
 - ✓ The blood pressure.
 - ✓ An assessment of the mental state.
- These are important in forming a judgement as to severity of the illness. CURB-65 score.

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❖ **Community-acquired pneumonia :-**

❑ **Clinical features :-**

- **Chest signs vary, depending on the inflammatory response.**

- **The inflammatory response Proceeds through stages of:-**
 - **Acute exudation.**

 - **Red hepatization.**

 - **Grey hepatization.**

 - **Resolution.**

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❖ Community-acquired pneumonia :-

❑ Clinical features :-

➤ When consolidated, the lung is typically:-

- **Percussion;-** dull to percussion.

- **Auscultation;-**

- ✓ Bronchial breathing.

- ✓ Whispering pectoriloquy.

- ✓ Crackles.

➤ An assessment of the state of nutrition is important, particularly in the elderly.

➤ The presence of herpes labialis may point to streptococcal infection, as may the finding of 'rusty' sputum.

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❖ **Community-acquired pneumonia :-**

□ **The differential diagnosis of pneumonia is:-**

- **Pulmonary infarction.**
- **Pulmonary/pleural tuberculosis.**
- **Pulmonary oedema (can be unilateral).**
- **Pulmonary eosinophilia.**
- **Malignancy: bronchoalveolar cell carcinoma.**
- **Cryptogenic organizing pneumonia/bronchiolitis obliterans organizing pneumonia (COP/BOOP).**

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❖ Community-acquired pneumonia :-

❑ Investigations :-

- The object of investigations is:-
 - Confirm the diagnosis.
 - Assess the severity.
 - Identify the development of complications.
- Many cases of mild to moderate CAP can be successfully managed without identification of the organism.
- A range of microbiological tests should be performed on patients with severe CAP.

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❖ Community-acquired pneumonia :-

❑ Investigations :-

➤ Blood :-

○ Full blood count

✓ Very high ($> 20 \times 10^9/L$) or low ($< 4 \times 10^9/L$) white cell count: marker of severity.

✓ Neutrophil leukocytosis $> 15 \times 10^9/L$: suggests bacterial a etiology.

✓ Hemolytic Anaemia: occasional complication of Mycoplasma.

○ Urea and electrolytes

✓ Urea $> 7 \text{ mmol/L}$ ($\sim 20 \text{ mg/dL}$): marker of severity.

✓ Hyponatremia: marker of severity.

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❖ **Community-acquired pneumonia :-**

❑ **Investigations :-**

➤ **Blood :-**

○ **Liver function tests**

✓ **Abnormal if basal pneumonia inflames liver.**

✓ **Hypoalbuminemia: marker of severity.**

○ **Erythrocyte sedimentation rate/C-reactive protein**

✓ **Non-specifically elevated.**

○ **Blood culture**

✓ **Bacteraemia: marker of severity.**

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❖ **Community-acquired pneumonia :-**

❑ **Investigations :-**

➤ **Blood :-**

○ **Cold agglutinins**

✓ **Positive in 50% of patients with Mycoplasma.**

○ **Arterial blood gases**

✓ **Measure when SaO₂ < 93%.**

✓ **When clinical features are severe.**

✓ **Assess ventilatory failure or acidosis.**

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❖ Community-acquired pneumonia :-

❑ Investigations :-

➤ Sputum

- ✓ Sputum samples, for Gram stain, culture and antimicrobial sensitivity testing.

➤ Oropharynx swab

- ✓ Polymerase chain reaction for *Mycoplasma pneumoniae* and other atypical pathogens.

➤ Urine

- ✓ Pneumococcal and/or *Legionella* antigen.

➤ Pleural fluid

- ✓ Always aspirate and culture when present in more than trivial amounts, preferably with ultrasound guidance.

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❖ Community-acquired pneumonia :-

❑ Investigations :-

➤ Chest X-ray

○ Lobar pneumonia

✓ Patchy opacification evolves into homogeneous consolidation of affected lobe.

✓ Air bronchogram (air-filled bronchi appear lucent against consolidated lung tissue) may be present.

○ Bronchopneumonia

✓ Typically patchy and segmental shadowing.

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❖ **Community-acquired pneumonia :-**

❑ **Investigations :-**

➤ **Chest X-ray**

○ **Complications**

✓ **Para-pneumonic effusion.**

✓ **Intrapulmonary abscess or empyema.**

○ **Staphylococcus aureus**

✓ **Suggested by multi-lobar shadowing, cavitation, pneumatoceles and abscesses.**

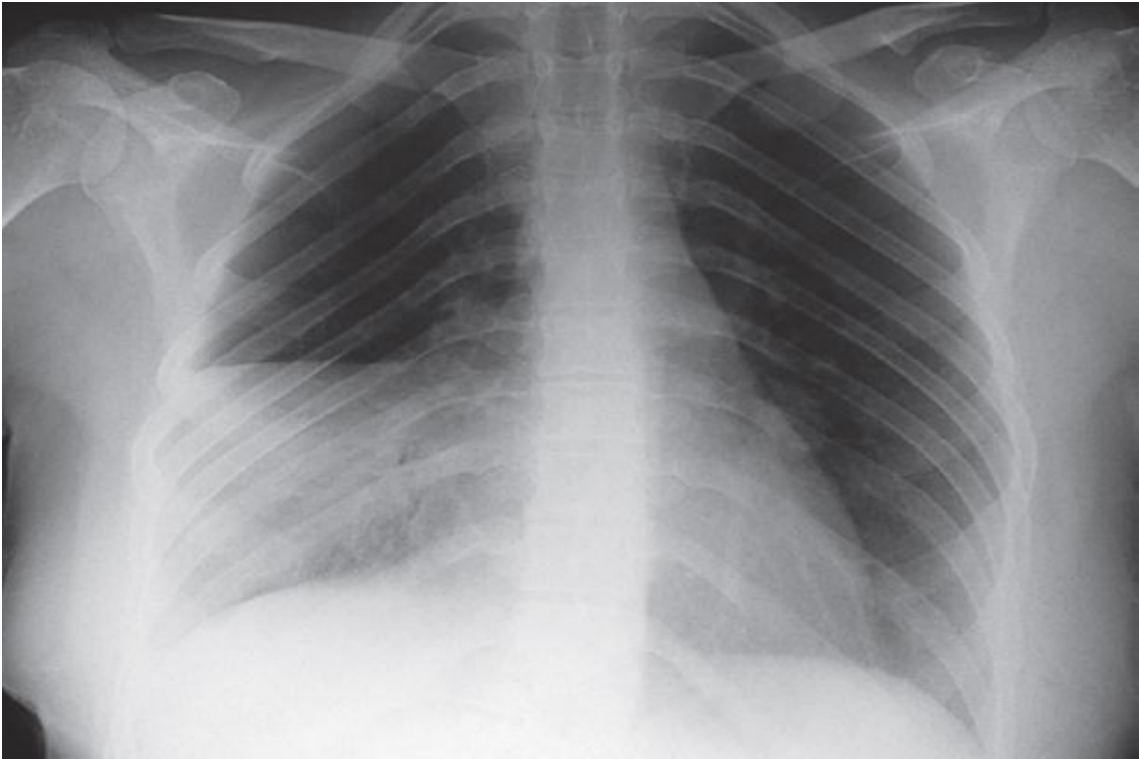
Pneumonia

❖ **Community-acquired pneumonia :-**

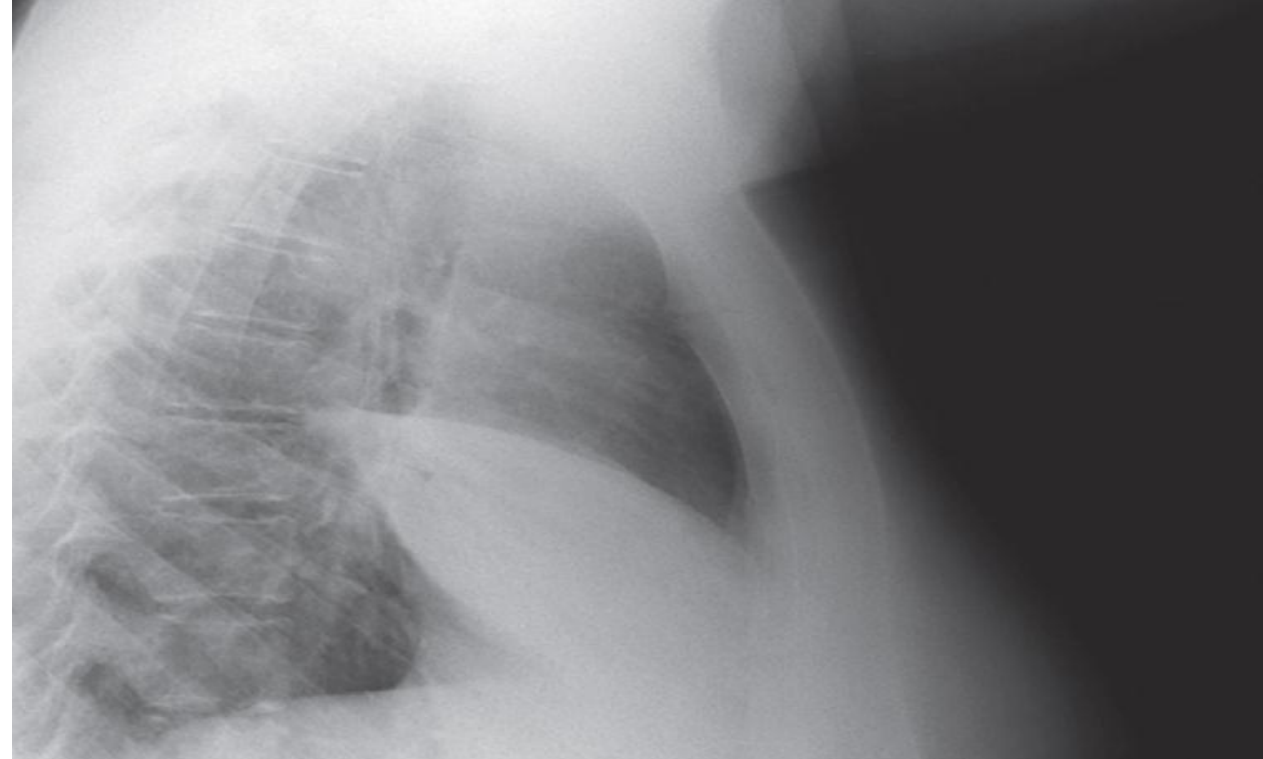
❑ **Investigations :-**

Pneumonia of the right middle lobe.

A Posteroanterior view: consolidation in the right middle lobe
Characteristic opacification beneath the horizontal fissure
Loss of normal contrast between the right heart border and lung.



B Lateral view: consolidation confined to the anteriorly situated middle lobe



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❖ Community-acquired pneumonia :-

❑ Management :-

➤ The most important aspects of management include;-

✓ Oxygenation.

✓ Fluid balance.

✓ Antibiotic therapy.

➤ In severe or prolonged illness, nutritional support may be required.

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❖ Community-acquired pneumonia :-

❑ Management :-

➤ Oxygen

○ Oxygen should be administered to all patients with:-

✓ Tachypnoea.

✓ Hypoxemia.

✓ Hypotension.

✓ Acidosis.

○ The aim of maintaining the $\text{PaO}_2 \geq 8 \text{ kPa}$ (60 mmHg) or $\text{SaO}_2 \geq 92\%$.

○ High concentrations ($\geq 35\%$), preferably humidified, should be used in all patients who do not have hypercapnia associated with COPD.

○ CPAP :- in those who remain hypoxic despite high-concentration oxygen therapy.

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❖ **Community-acquired pneumonia :-**

❑ **Management :-**

○ **Indications for ITU referral are:-**

- ✓ CURB score of 4–5, failing to respond rapidly to initial management.
- ✓ Persisting hypoxia ($\text{PaO}_2 < 8 \text{ kPa}$ (60 mmHg)), despite high concentrations of oxygen.
- ✓ Progressive hypercapnia.
- ✓ Severe acidosis.
- ✓ Circulatory shock.
- ✓ Reduced conscious level.

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❖ **Community-acquired pneumonia :-**

❑ **Management :-**

➤ **Fluid balance**

- **Intravenous fluids should be considered in those with severe illness, in older patients and those with vomiting.**
- **May be appropriate to discontinue hypertensive agents temporarily.**
- **An adequate oral intake of fluid should be encouraged.**
- **Inotropic support may be required in patients with shock.**

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❖ **Community-acquired pneumonia :-**

❑ **Management :-**

➤ **Antibiotic treatment**

- **Prompt administration of antibiotics improves the outcome.**
- **The initial choice of antibiotic is guided by:-**
 - ✓ **Clinical context.**
 - ✓ **Severity assessment.**
 - ✓ **Local knowledge of antibiotic resistance patterns.**
 - ✓ **Epidemiological information.**

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❖ Community-acquired pneumonia :-

❑ Management :-

➤ Antibiotic treatment

- In most patients with uncomplicated pneumonia a 5-day course is adequate.
- Treatment is usually required for longer in patients with Legionella, staphylococcal or Klebsiella pneumonia.
- Oral antibiotics are usually adequate unless the patient has:-
 - ✓ A severe illness.
 - ✓ Impaired consciousness.
 - ✓ Loss of swallowing reflex.
 - ✓ Functional or anatomical reasons for malabsorption.

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❖ **Community-acquired pneumonia :-**

❑ **Management :-**

➤ **Treatment of pleural pain**

- Is important to relieve pleural pain in order to allow the patient to breathe normally and cough efficiently.
- Simple analgesia with paracetamol, or NSAIDs is sufficient in the majority.
- Opiates may be required In some patients.
- ✓ Must be used with extreme caution in individuals with poor respiratory function.

➤ **Physiotherapy**

- ✓ Not usually indicated in patients with CAP.
- ✓ May be helpful to assist expectoration in patients who suppress cough because of pleural pain.

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❖ Community-acquired pneumonia :-

❑ Prognosis :-

- Most patients respond promptly to antibiotic therapy.
- Fever may persist for several days.
- The chest X-ray often takes several weeks or even months to resolve, especially in old age.
- The mortality rate of adults with non-severe pneumonia is very low (< 1%).
- Hospital death rates are typically between 5% and 10% but may be as high as 50% in severe illness.
- Delayed recovery suggests either:-
 - ✓ A complication has occurred.
 - ✓ The diagnosis is incorrect.
 - ✓ The pneumonia may be secondary to a proximal bronchial obstruction or recurrent aspiration.

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❖ **Community-acquired pneumonia :-**

❑ **Complications of pneumonia :-**

- **Para-pneumonic effusion – common.**
- **Empyema.**
- **Retention of sputum causing lobar collapse.**
- **Deep vein thrombosis and pulmonary embolism.**
- **Pneumothorax, particularly with Staphylococcus aureus.**
- **Suppurative pneumonia/lung abscess.**

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❖ **Community-acquired pneumonia :-**

❑ **Complications of pneumonia :-**

- **ARDS, renal Failure, multi-Organ Failure.**
- **Ectopic abscess formation (Staph. aureus).**
- **Hepatitis, pericarditis, myocarditis, meningoencephalitis.**
- **Arrhythmias (e.g. atrial fibrillation).**
- **Pyrexia due to drug hypersensitivity.**

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❖ Community-acquired pneumonia :-

❑ Discharge and follow-up :-

- The decision to discharge a hospitalized patient depends on the home circumstances and the likelihood of complications.
- A chest X-ray need not be repeated before discharge in patients making a satisfactory clinical recovery.
- Clinical review by GP or hospital should be arranged around 6 weeks later.
- A chest X-ray obtained if there are persistent symptoms, physical signs or reasons to suspect underlying malignancy.

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❖ Community-acquired pneumonia :-

❑ Prevention :-

- Current smokers should be advised to stop.
- Influenza and pneumococcal vaccination should be considered in patients at highest risk of pneumonia.
- Legionella pneumophila has important public health implications and usually requires notification to the appropriate health authority for investigation of potential sources.
- In resource-poor settings, tackling malnourishment and indoor air pollution, and encouraging immunization against measles, pertussis and Hemophilus influenzae type b are particularly important in children.

Pneumonia

❖ Hospital-acquired pneumonia :-

- HAP or nosocomial pneumonia refers to a new episode of pneumonia occurring at least 2 days after admission to hospital.
- Is the second most common hospital-acquired infection (HAI) and the leading cause of HAI associated death.
- The elderly are particularly at risk, as are patients in intensive care units.
- Ventilator-associated pneumonia(VAP) refers to HAP in patients in ICU when mechanically ventilated.

Pneumonia

❖ Hospital-acquired pneumonia :-

- Health-care-associated pneumonia (HCAP) refers to the development of pneumonia in a person who has:-
 - ✓ Spent at least 2 days in hospital within the last 90 days.
 - ✓ Attended a hemodialysis unit.
 - ✓ Received intravenous antibiotics.
 - ✓ Been resident in a nursing home.
 - ✓ Been other long-term care facility.

Pneumonia

❖ Hospital-acquired pneumonia :-

➤ The factors predisposing to the development of pneumonia in a hospitalized patient are:-

- **Reduced host defenses against bacteria**
 - ✓ Reduced immune defenses.
 - ✓ Reduced cough reflex (e.g. post-operative).
 - ✓ Disordered conciliar clearance (e.g. anesthetic agents).
 - ✓ Bulbar or vocal cord palsy.
- **Aspiration of nasopharyngeal or gastric secretions**
 - ✓ Immobility or reduced conscious level.
 - ✓ Vomiting, dysphagia (N.B. stroke disease), achalasia or severe reflux.
 - ✓ Nasogastric intubation.

Pneumonia

❖ Hospital-acquired pneumonia :-

➤ The factors predisposing to the development of pneumonia in a hospitalized patient are:-

○ Bacteria introduced into lower respiratory tract

- ✓ Endotracheal intubation/tracheostomy.
- ✓ Infected ventilators/nebulizers/bronchoscopes.
- ✓ Dental or sinus infection.

○ Bacteraemia

- ✓ Abdominal sepsis.
- ✓ Intravenous cannula infection.
- ✓ Infected emboli.

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❖ Hospital-acquired pneumonia :-

❑ Clinical features and investigation:-

➤ Considered in any hospitalized or ventilated patient who develops:-

- Purulent sputum (or endotracheal secretions).

- New radiological infiltrates.

- Unexplained increase in oxygen requirement

- A core temperature $> 38.3^{\circ}\text{C}$.

- A leukocytosis or leucopenia.

➤ The clinical features and radiographic signs are variable and non-specific.

Pneumonia

❖ Hospital-acquired pneumonia :-

❑ Clinical features and investigation:-

- In contrast to CAP, microbiological confirmation should Be sought whenever possible.
- Adequate sputum samples may be difficult to obtain in the frail elderly person and physiotherapy should be considered to aid expectoration.
- In patients who are mechanically ventilated, bronchoscopy-directed protected brush specimens, bronchoalveolar lavage (BAL) or endotracheal aspirates may be obtained.

Pneumonia

❖ Hospital-acquired pneumonia :-

☐ Management :-

- The principles of management are similar to those of CAP, focusing on adequate oxygenation, appropriate fluid balance and antibiotics.
- The organisms implicated in early-onset HAP (occurring within 4–5 days of admission) are similar to those involved in CAP.
- In patients who have received no previous antibiotics, co-amoxiclav or cefuroxime represents a sensible choice.
- If the patient has received a course of recent antibiotics, then piperacillin/tazobactam or a third-generation cephalosporin should be considered.

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❖ Hospital-acquired pneumonia :-

📄 Management :-

- Late-onset HAP is more often attributable to Gram-negative bacteria, Staph. Aureus, and anaerobes, and the choice of antibiotics ought to cover these possibilities.
- The choice of agents is most appropriately guided by knowledge of local patterns of microbiology and antibiotic resistance.
- It is sensible to commence broad-based cover, discontinuing less appropriate antibiotics as culture results become available.
- In the absence of good evidence, the duration of antibiotic therapy remains a matter for clinical judgement.
- Physiotherapy is important to Aid expectoration in the immobile and elderly, and adequate nutritional support is often required.

Pneumonia

❖ Hospital-acquired pneumonia :-

❑ Prevention :-

- Despite appropriate management, the mortality from HAP is high (approximately 30%), mandating prevention whenever possible.
- Good hygiene is paramount, particularly with regard to hand-washing and any equipment used.
- Steps should be taken to minimize the chances of aspiration and to limit the use of stress ulcer prophylaxis with proton pump inhibitors.
- Oral antiseptic (chlorhexidine 2%) may be used to decontaminate the upper airway and some intensive care units employ selective decontamination of the digestive tract when the anticipated requirement for ventilation will exceed 48 hours.

Pneumonia

- ❖ **Suppurative pneumonia, aspiration pneumonia and pulmonary abscess :-**
- **These conditions are considered together, as their a etiology and clinical features overlap.**
- **Suppurative pneumonia is characterized by destruction of the lung parenchyma by the inflammatory process.**
- **Pulmonary abscess' is usually taken to refer to lesions in which there is a large localized collection of pus, or a cavity lined by chronic inflammatory tissue.**
- **Suppurative pneumonia and pulmonary abscess often develop after the inhalation of septic material during operations on the nose, mouth or throat, under general anesthesia, or of vomitus during anesthesia or coma, particularly if oral hygiene is poor.**

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❖ Suppurative pneumonia, aspiration pneumonia and pulmonary abscess :-

- Additional risk factors for aspiration pneumonia include bulbar or vocal cord palsy, achalasia or Oesophageal reflux, and alcoholism.
- Aspiration tends to localize to dependent areas of the lung, such as the apical segment of the lower lobe in a supine patient.
- It may complicate local bronchial obstruction from a neoplasm or foreign body.
- Infections are usually due to a mixture of anaerobes and aerobes in common with the typical flora encountered in the mouth and upper respiratory tract.
- Suppurative pneumonia or a pulmonary abscess occurs in a previously healthy lung, the most likely infecting organisms are *Staph. aureus* or *K. pneumoniae*.

Pneumonia

- ❖ **Suppurative pneumonia, aspiration pneumonia and pulmonary abscess :-**
- ***Actinomyces* infections cause chronic suppurative pulmonary infections, which may be associated with poor dental hygiene.**
- **Bacterial infection of a pulmonary infarct or a collapsed lobe may also produce a suppurative pneumonia or lung abscess.**
- **In many cases, no pathogen can be isolated, particularly when antibiotics have been given.**
- **Some strains of community-acquired MRSA (CA-MRSA) produce the cytotoxin.**
- **The organism is mainly responsible for suppurative skin infection but may be associated with rapidly progressive severe necrotizing pneumonia.**

Pneumonia

- ❖ **Suppurative pneumonia, aspiration pneumonia and pulmonary abscess :-**
- **Lemierre's syndrome is a rare cause of pulmonary abscesses.**
- **The usual causative agent is the anaerobe *Fusobacterium necrophorum*.**
- **The illness typically commences as a sore throat, spread into the jugular veins leads to thrombosis and metastatic dispersal of the organisms.**
- **Injecting drug-users are at particular risk of developing hematogenous lung abscess, often in association with endocarditis affecting the pulmonary and tricuspid valves.**
- **A non-infective form of aspiration pneumonia, exogenous lipid pneumonia, may follow the aspiration of animal, vegetable or mineral oils.**

Pneumonia

❖ **Suppurative pneumonia, aspiration pneumonia and pulmonary abscess :-**

➤ **Clinical features of suppurative pneumonia**

☐ **Symptoms**

- **Cough with large amounts of sputum, sometimes fetid and blood-stained.**
- **Pleural pain common.**
- **Sudden expectoration of copious amounts of foul sputum if abscess ruptures into a bronchus.**

Pneumonia

❖ **Suppurative pneumonia, aspiration pneumonia and pulmonary abscess :-**

➤ **Clinical features of suppurative pneumonia**

□ **Clinical signs**

- **High remittent pyrexia.**
- **Profound systemic upset.**
- **Digital clubbing may develop quickly (10–14 days).**
- **Consolidation on chest examination; signs of cavitation rarely found.**
- **Pleural rub common.**
- **Rapid deterioration in general health, with marked weight loss if not adequately treated.**

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Pneumonia

❖ **Suppurative pneumonia, aspiration pneumonia and pulmonary abscess :-**

❑ **Investigations :-**

➤ **Radiological features of :-**

- **Suppurative pneumonia include homogeneous lobar or segmental opacity consistent with consolidation or collapse.**
- **Abscesses are characterized by cavitation and a fluid level.**
- ✓ **Occasionally, a pre-existing emphysematous bulla becomes infected and appears as a cavity containing an air–fluid level.**

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❖ **Suppurative pneumonia, aspiration pneumonia and pulmonary abscess :-**

❑ **Management :-**

- **Aspiration pneumonia can usually be treated with amoxicillin and metronidazole.**
- **Co-amoxiclav also has a suitable antibiotic spectrum but increases the risk of Clostridium difficile infection.**
- **Further modification of antibiotics should be informed by clinical response and microbiological results.**
- **CA-MRSA is usually susceptible to a variety of oral non- β -lactam antibiotics.**
- **Parenteral therapy with vancomycin or linezolid can also be considered.**
- **Fusobacterium necrophorum is highly susceptible to β -lactam antibiotics and to metronidazole, clindamycin and third-generation cephalosporins.**

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❖ **Suppurative pneumonia, aspiration pneumonia and pulmonary abscess :-**

❑ **Management :-**

- **Prolonged treatment for 4–6 weeks may be required in some patients with lung abscess.**
- **Established pulmonary actinomycosis requires 6–12 months' treatment with intravenous or oral penicillin, or with a tetracycline in penicillin-allergic patients.**
- **Physiotherapy is of great value, especially when suppuration is present in the lower lobes or when a large abscess cavity has formed.**
- **In most patients there is a good response to treatment, and although residual fibrosis and bronchiectasis are common sequelae, these seldom give rise to serious morbidity.**
- **Surgery should be contemplated if no improvement occurs despite optimal medical therapy.**
- **Removal or treatment of any obstructing endobronchial lesion is essential.**

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❖ Pneumonia in the immunocompromised patient :-

- Patients immunocompromised by drugs or disease are at increased risk of pulmonary infection.
- Pneumonia is the most common cause of death in this group.
- The majority of infections are caused by the same pathogens that cause pneumonia in immunocompetent individuals.
- In patients with more profound immunosuppression less common organisms, or those normally considered to be of low virulence or non-pathogenic, may become 'opportunistic' pathogens.
- Depending on the clinical context, clinicians should consider the possibility of Gram-negative bacteria, and less common organisms such as *Nocardia* spp. Infection is often due to more than one organism.

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❖ Pneumonia in the immunocompromised patient :-

☐ Clinical features :-

- Typically include fever, cough and breathlessness but are influenced by the degree of immunosuppression, and the presentation may be less specific in the more profoundly immunosuppressed.
- The onset of symptoms tends to be swift in those with a bacterial infection but more gradual in patients with opportunistic organisms such as *Pneumocystis jirovecii* and mycobacterial infections.
- In *P. jirovecii* pneumonia, symptoms of cough and breathlessness can be present several days or weeks before the onset of systemic symptoms or the appearance of radiographic abnormality.
- The clinical features of invasive pulmonary aspergillosis are dealt with on other title.

Pneumonia

❖ Pneumonia in the immunocompromised patient :-

❑ Investigations :-

- The approach is informed by the clinical context and severity of the illness.
- Invasive investigations, such as bronchoscopy, BAL, transbronchial biopsy or surgical lung biopsy, are often impractical, as many patients are too ill to undergo these safely.
- ‘induced sputum’ offers a relatively safe method of obtaining microbiological samples.
- HRCT can be helpful for diagnosis.

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❖ Pneumonia in the immunocompromised patient :-

❑ Management :-

- In theory, treatment should be based on an established a etiological diagnosis.
- In practice, however, the causative agent is frequently unknown.
- Factors that favor a bacterial a etiology include neutropenia, rapid onset and deterioration.
- ✓ Broad-spectrum antibiotic therapy should be commenced immediately, e.g. a third-generation cephalosporin, or a quinolone, plus an ant staphylococcal antibiotic, or an antipseudomonal penicillin plus an aminoglycoside.

Pneumonia

❖ Pneumonia in the immunocompromised patient :-

❑ **Management :-**

- Thereafter, treatment may be tailored according to the results of investigations and the clinical response.
- Depending on the clinical context and response to treatment, antifungal or antiviral therapies may be added.

